# THE UNITED REPUBLIC OF TANZANIA
# NATIONAL EXAMINATIONS COUNCIL
# DIPLOMA IN SECONDARY EDUCATION EXAMINATION

**732/2A**

## CHEMISTRY 2A
## (ACTUAL PRACTICAL A)

**Time: 3 Hours** **Thursday, 17th May 2012 a.m.**

### Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question 1 carries **forty (40)** marks and the rest carry **thirty (30)** marks each.
4. A qualitative analysis guide pamphlet for answering question number 3 may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Mathematical tables and non-programmable calculators may be used.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. The following constants might be useful in your calculations:

   Atomic masses:

   H = 1; C = 12; O = 16; Na = 23; S = 32; K = 39; Mn = 55.

   1 Litre = $1dm^3 = 1000cm^3$.



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1. You are provided with the following requirements:

**NN:** A solution made by dissolving 2.5 g of potassium permanganate ($KMnO_4$) in distilled water to make 500 $cm^3$ of a solution.

**LL:** A solution of 5.67 g of oxalic acid ($H_2C_2O_4.XH_2O$) in distilled water to make 750 $cm^3$ of a solution mixture;

Dilute sulphuric acid (2M $H_2SO_4$);

Thermometer.

**Procedure:**

(i) Place the beaker containing about 150 $cm^3$ of tap water into a 200 $cm^3$. Maintain the temperature of water at above 80 $^0C$. This is your water bath.

(ii) Put solution **NN** into a burette.

(iii) Pipette out 20 $cm^3$ (or 25 $cm^3$) of **LL** into a clean conical flask. Add to it 25 $cm^3$ of $H_2SO_4$ and heat the mixture until the solution attains a temperature of $70^0C$ - $80^oC$; then titrate it against hot solution mixture of **LL** until permanent colour change occurs.

(iv) Repeat procedure (i) and (iii) three more times.

**Questions:**

(a) Record your results in tabular form as shown in Table 1.

(i) Table 1: Titration results.

| Titration No. | Trial | 1 | 2 | 3 |
|---|---|---|---|---|
| Final volume ($cm^3$) | | | | |
| Initial volume ($cm^3$) | | | | |
| Volume used ($cm^3$) | | | | |

(ii) State clearly what you have observed in terms of colour change at the end point.

(iii) Find the average titre volume.

(b) Show:

(i) the half- reaction equations for the reacting species.

(ii) net ionic equation for this experiment.

(c) Calculate the:

(i) molarity of potassium permanganate.

(ii) concentration of potassium permanganate in $g/dm^3$.



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(d) Determine:
(i) concentration of $H_2C_2O_4.XH_2O$ in g/dm$^3$.
(ii) concentration of $H_2C_2O_4$ in mol/dm.$^3$
(iii) concentration of $H_2C_2O_4$ in g/dm$^3$.
(iv) value of X in $H_2C_2O_4.XH_2O$.

(e) If $H_2O$ is regarded as an impurity, find the percentage purity of the acid.

2. You are provided with the following materials:

**P:** A solution of 0.25M $Na_2S_2O_3$ (sodium thiosulphate);

**Q:** A solution of 0.5M HCl;

Distilled water;

Stopwatch;

Small beaker (50cm$^3$);

Two 10 cm$^3$ measuring cylinders.

**Procedure:**

(i) Put an empty beaker (50cm$^3$) on top of the clear mark **"X"** printed on the white piece of paper in such a way that the mark is clearly seen from the top of the beaker.

(ii) Using a 10cm$^3$ measuring cylinder (or burette) measure out 4 cm$^3$ of **P** and 6 cm$^3$ of distilled water and put them in the 50 cm$^3$ beaker on top of the piece of paper.

(iii) Using another 10 cm$^3$ measuring cylinder (or burette) measure out 10cm$^3$ of **Q** and at a convenient time pour **Q** into the beaker containing **P** and distilled water; and immediately start the stopwatch.

(iv) Record the time taken to cause enough precipitations to hide completely mark **"X"** on the beaker.

(v) Repeat the experiment with other concentrations as shown in Table 2.1.

Table 2.1: Experiment procedure

| Experiment No. | Vol. of $Na_2S_2O_3$ (cm$^3$) | Vol. of $H_2O$ (cm$^3$) | Vol. of HCl (cm$^3$) |
|---|---|---|---|
| 1 | 4 | 6 | 10 |
| 2 | 6 | 4 | 10 |
| 3 | 8 | 2 | 10 |
| 4 | 10 | - | 10 |



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Record your results in tabular form as shown in Table 2.2.

Table 2.2: Experimental results

| Experiment No. | Vol. of $Na_2S_2O_3$ ($cm^3$) | Time t(s) | $\frac{1}{t}(s^{-1})$ |
|---|---|---|---|
| 1 | 4 | | |
| 2 | 6 | | |
| 3 | 8 | | |
| 4 | 10 | | |

**Questions:**

(a) State why:
(i) the precipitated were formed in this experiment.
(ii) did it take shorter time for the cross to disappear in experiment 3?

(b) Given that the volumes of individual solutions are directly proportional to their concentrations and the rate of reaction is given by the equation:

$$\text{Rate} = k[S_2O_3^{2-}]^m [HCl]^n$$

(i) Calculate the value of **m.**
(ii) Write a balanced ionic equation for reaction for this experiment.
(iii) Given that the value of n = 2, find the value of **k.**
(iv) Write the rate law of the reaction in this experiment.
(v) Find the rate of reaction when the time taken for letter **"X"** to disappear is 24 seconds.

(c) Explain how the rate of reaction will be affected if :
(i) the concentration of HCl is increased.
(ii) warm thiosulphate solution is used.



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3. You are given sample of compound **T** which contains one **cation** and one **anion.**

(a) Carry out a qualitative analysis to identify the cation and anion present in salt using the tests provided in Table 3.

Table 3: Experimental results

| S/N | Experiment | Observation | Inference |
|---|---|---|---|
| (a) | Appearance of sample | | |
| (b) | Flame test. | | |
| (c) | Solubility. | | |
| (d) | Action with heat. | | |
| (e) | Action with dil. $H_2SO_4$ | | |
| (f) | Action with concentrated $H_2SO_4$. | | |
| (g) | Action with aqueous NaOH. | | |
| (h) | Action with aqueous $NH_3$. | | |
| (i) | Action with potassium chromate solution. | | |
| (j) | Action with potassium iodide solution followed by heating. | | |
| (k) | Action of sample solution with $FeSO_4$ and concentrated $H_2SO_4$. | | |

(b) Write a conclusion of the results indicating the following:
(i) The cation and anion.
(ii) Molecular formula of a salt.

(c) Write the reactions equation to:
(i) illustrate what took place in experiment (d).
(ii) ionic equation for reactions in experiment (g).

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